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ABSTRACT

An interactive, computerized model developed for Old Dominion University utilizes university historical data, demographic characteristics, projected selected economic variables and population figures by various age groups and planning districts to forecast enrollment, financial projections, and future fiscal conditions of the institution. The planning model consists of four modules which can be executed on an individual basis to compute market share, headcount, full time equivalent (FTE) profile and financial profile projections. Multiple iterations may be performed on any module or stored online for future reference. The model has been used to compute the university's state market share per planning district, headcount distributions by student level, FTEs by student level, FTEs by activity (on-campus, off-campus and summer school), distribution per specialized or non-specialized program and dollar amounts derived through faculty allocation ratios. With the flexibility built into the model, many more individualized applications are possible. University administrators may use this computerized model to receive immediate answers to difficult financial problems posed when a given fiscal variable or group of variables change. Appendices include a flow chart of the model, a sample headcount control file and a sample headcount output file. (DC)

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COMPUTERIZED ENROLLMENT DRIVEN
FINANCIAL FORECASTING MODEL

U.S. DEPARTMENT OF HEALTH,
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EXECUTIVE SUMMARY

Purpose

The purpose of this paper is to provide a general overview of a comprehensive computerized university planning model. This paper has not been intended to be a detail description of the planning model for two reasons. First, all phases of the model have not been finalized and are still in the development stage. Second, the overall intent of this paper is to provide the readers with a generalized conceptual framework of the model and not a detailed instruction of how to use it. More information may be obtained by contacting the author at Old Dominion University either by phone or by written request.

Need for the Model

The initial intent of the university planning model concept was designed to accomplish three things. First, the university had a desire to expedite state reporting requirements, such items as enrollment projections, FTE projections, etc. Second, the planning model concept was undertaken to provide management with a quick and easy method of providing answers to selected "what if" questions. In addition, it would give management a general idea of the sensitivity of a given decision or decisions by holding all other variables constant. Third, and probably foremost, it would provide central management with immediate answers to determine the financial impact on the university when a given variable or variables change. Overall, it was felt that by computerizing many of the manual data manipulation tasks it would allow central management to be true managers as opposed to the historical university administrator.

Assumptions

The development or implementation of any planning model requires some assumptions. In order for this model to be useful the following variables or items must be understood. First, it is assumed that enrollment is primarily a function of population. Some manipulation of the available population for higher education may be conducted through changing economic variables or demographic variables; however, this model still assumes that the primary source or environment which creates enrollments is population. The next assumption that Old Dominion made was to identify itself as an urban institution. With this concept in mind, the University was able to determine that the bulk of its population or market could be derived from the local 18-34 year old age group. The remaining market which was outside the Tidewater area would be confined to the 18-21 year old age group. The next major assumption that this institution undertook was to determine that it could have some

impact on its available market share, i.e. through new programs, advertising, etc. In addition, the University also made the assumption that it could have some impact on progression ratios or retention of students through the refinement of some existing programs or new programs. Last, and perhaps foremost, the University assumed that it could have some impact on the Virginia State Council or General Assembly through either negotiations or political pressure.

MODEL OVERVIEW

The overall planning model that Old Dominion University has implemented consists of four submodels which are:¹

1. Market share profile and projections
2. Headcount profile and projections
3. FTE profile and projections
4. Financial profile and projections.

Each of these submodels is in reality a model in itself in that it can be executed or manipulated independent of the overall model. In other words, each submodel may be executed or developed until management feels that it has a valid representation of the current environment of the University or until realistic projections are obtained. During the entire development process of the projections, each iteration of any submodel may be stored uniquely on disk and recalled at any given time. Overall, each submodel consists of a Control File², which has the variable name, a function code, mathematical or subroutine, a data source file line number, and a ratio file line number. In addition to the Control File each submodel requires a history file and a data file, or if the user specifies, two data files. With the input of these four files, the output from each model will be a hard copy listing³ and a data file or files which may be used in the subsequent model. In order to gain a better understanding of a given model, each model that Old Dominion is currently using will be covered briefly.

Market Share Model

The Market Share Model is primarily designed to generate the incoming Freshman class to Old Dominion University from both a degree and non-degree status. The first step in providing ODU with its market share is to establish historical profiles based on planning districts. The Freshman class is analyzed and grouped by zip code and is later grouped by planning districts. Using several years of historical data expected returns or expected future enrollments from a given planning district and based against future population economic factors, a future market share is derived. Once the future market share for each planning district is determined, the summation of all the planning districts will provide Old Dominion with its expected future Freshman class. Many iterations may be performed and many assumptions may be used in developing the market shares, such as the availability of housing, rises or falls in the economy, new programs, transfer students, etc. In addition, various age groups may be applied to different planning districts and the market share may be changed for different years. Once a realistic market share is decided on this data is then stored for future retrieval which will be the basic input data into the headcount model. At the present time, projections may be as far as 14 years out or as close as 2 year out.

¹See Appendix A - Computerized Enrollment Driven Financial Forecasting Model Flowchart

²See Appendix B - Sample Control File for the Headcount Model

³See Appendix C - Sample Output Listing for the Headcount Model

Headcount Model

The Headcount Model performs in the same manner as the Market Share Model or any other model. It has the same number of basic input required files, uses the same source programs to execute or edit the files, and, in simplistic terms, is a model in itself. The Headcount Model takes the incoming Freshman class or market share which was generated in the previous model, both degree, non-degree, in-state, out-of-state, and based on historic headcount profiles progresses that data through Old Dominion University to come up with a bottom line total undergraduate class. In addition, various other features are added in the Headcount Model which brings into account new programs which will be coming on-line several years down the road in both the undergraduate and graduate program. For a doctoral institution, the model can also be used to progress the undergraduate class through first year and/or advanced graduates. Again, the Headcount Model, like the Market Share Model, may be executed over and over again changing many variables, making many assumptions to enable central management to ascertain the immediate impact of a given variable. As with the Market Share Model, each iteration may be uniquely stored on-line and retrieved at any time to see the effect of different assumptions.

FTE Model

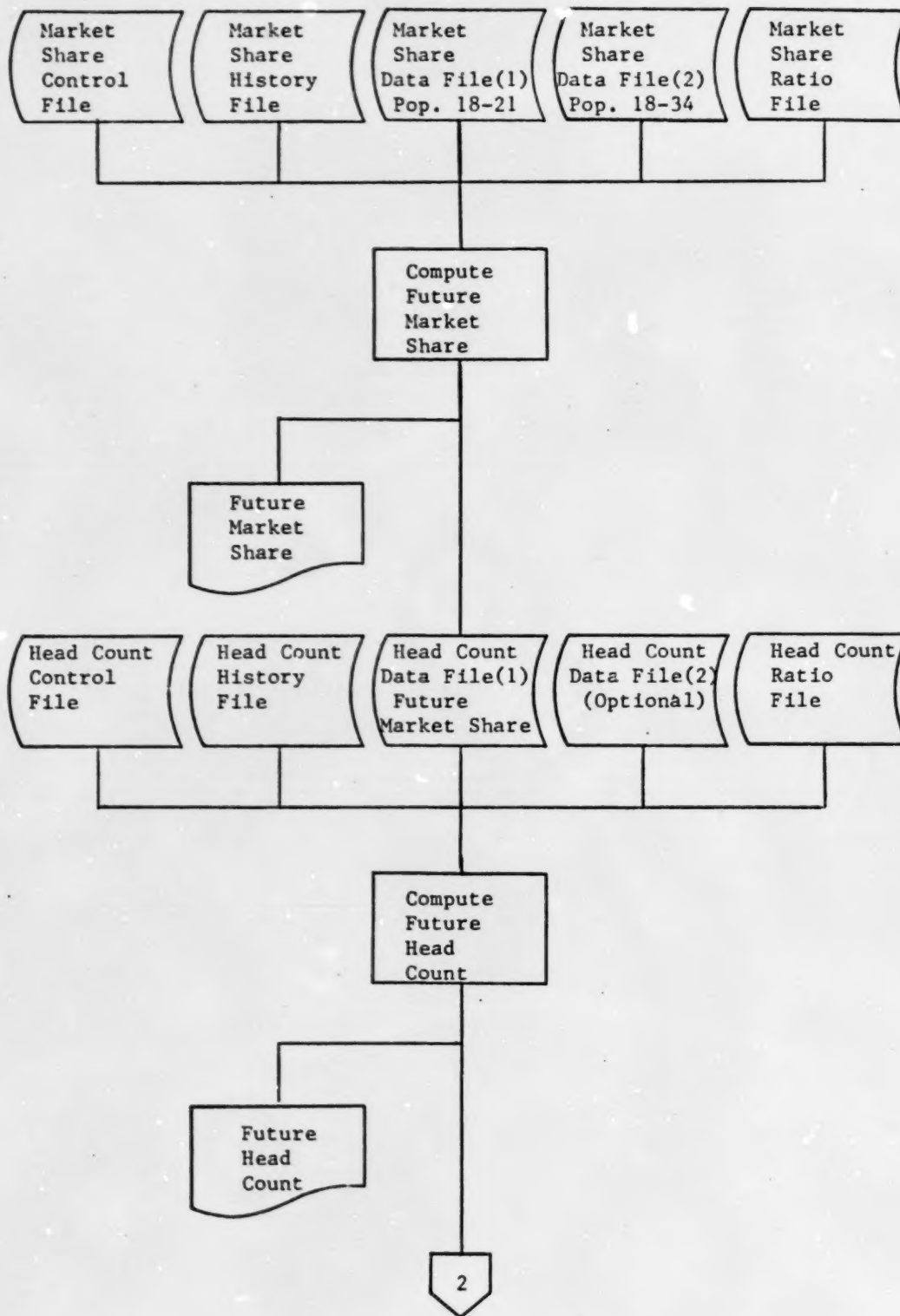
The FTE Model takes the output data from the Headcount Model, and like the two previous models, based on FTE historical profile progresses the data through the model to determine what various FTEs will be at various levels, such as lower level undergraduates, upper level undergraduates, first graduates, and advanced graduates. The primary output or objective of this model is to provide the University with the data for state reporting and enrollment projections.

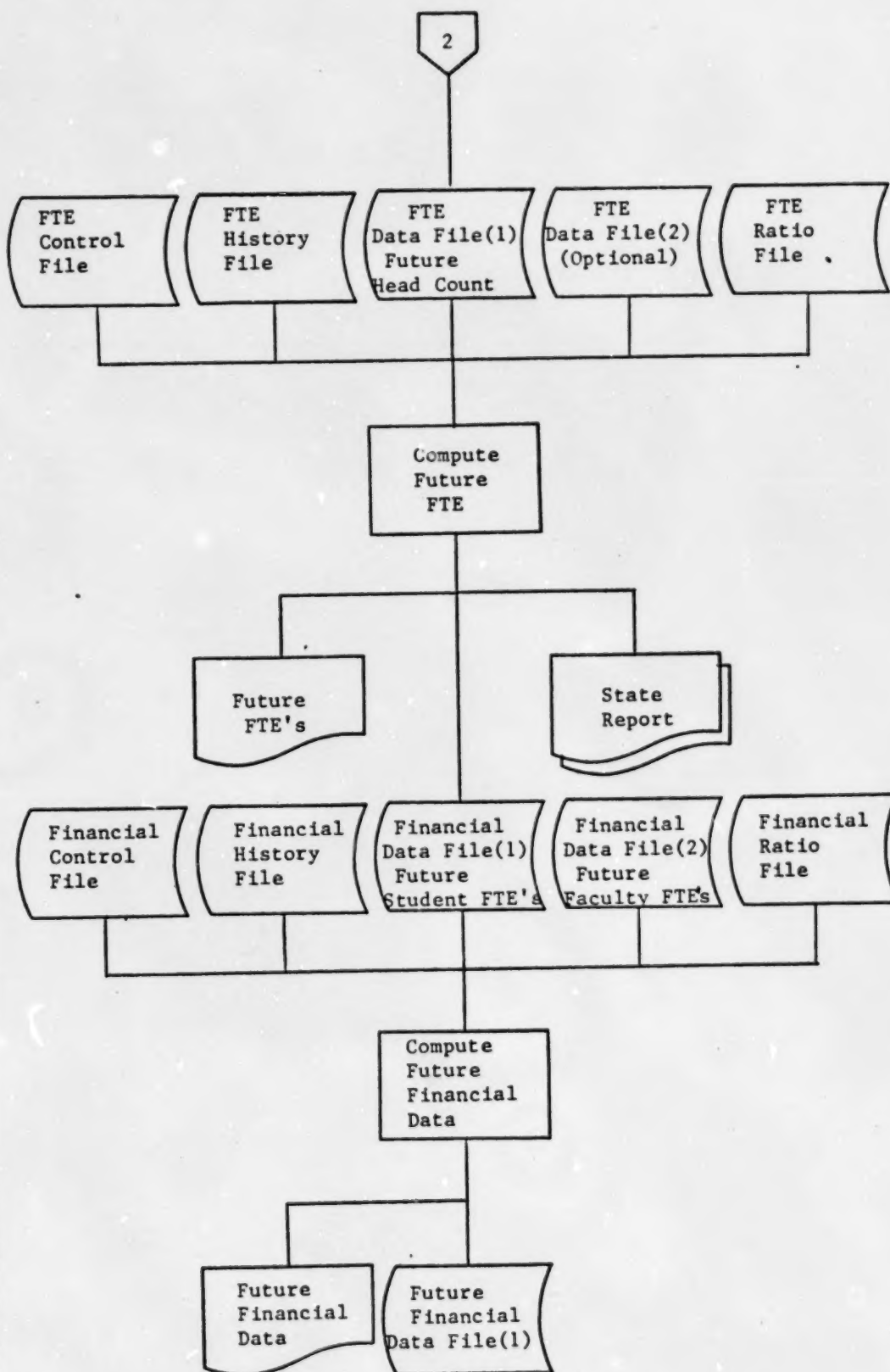
Financial Model

The last model, which is perhaps the most complicated model, is the Financial Model. This model takes FTE data and based on historical financial profile and ratios derived by the State of Virginia progresses the FTE data through the model and generates faculty FTE positions which, in turn, generated classified and administrative faculty positions. These positions can then be broken down into full-time and part-time and processes against faculty salary averages to ultimately give bottom line figures as to the instruction side of the budget. In addition, other ratios can be used to take this data and develop the remaining portion of the budget to derive what the bottom line financial impact will be on the University. Again, this model and the previous models may have many iterations and each iteration may be stored uniquely on-line and recalled at any time to ascertain what a new or different assumption will have.

SUMMARY

Overall, the current University planning model consists of four working models which can be executed on an individual basis. In addition to the four models already mentioned, work is currently in progress to provide an indepth faculty profile which can be interfaced and entered as another submodel to find out additional financial impacts on the University's long range planning. From the standpoint of the actual execution and manipulation of a model, all models operate basically the same since they are all controlled by the same software program. In the most simplistic terms, each model consist of (1) a Control File, which stipulates format, mathematical function, data file sources, ratio file source, output format, etc.; (2) History File, which consist of up to five years of historical data which can be used to generate means, averages, expected returns or progression ratios; (3) a Ratio File, which consist of either inflation rates, economic data, demographic data, or any type of mathematical equation that the operator may desire; (4) Data File, which consist of such things as basic population, market share, headcount, FTE, etc. In addition to the four previous files, a fifth file, which is optional, may be used. This is simply an additional Data File. An example of an additional Data File may be a population by planning district of a different age group. Therefore, the user has the option of selecting data from more than one file to derive more than one set of results within a given planning district. In addition to the description of the model as a whole and the models specifically, the software also maintains a log of each individual model to keep track of variables that are changed from one model to the next. This log and the additional option to print the Ratio Files results in a University planning model which is self documenting.





APPENDIX B

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LIN	REC	-----DESCRIPTION-----	FORM	LF	VAR1	VAR2	VAR3	VAR4	VAR5
010	002	MODEL	0001	01					
020	001	ENROLLMENT PROJECTIONS	0001	01					
030	001	OLD DOMINION UNIVERSITY	0001	01					
040	001	NOFFOLK VIRGINIA	0001	03					
050	003	DATE/TIME-FUNCTION	0001	03					
070	004	PAGE-FUNCTION	0001	03					
080	005	(YEARS)	0002	02=0001					
100	001	FRESHMAN CLASS:	0015	02					
130	001	PROJECTED 1ST TIME FRESHMAN	0002	03=0002					
140	003	1ST TIME DEGREE FRESH IN-STATE	0001	01=L130*R001					
150	003	1ST TIME DEG. FRESH OUT/STATE	0002	01=L130*R002					
160	001	TOTAL 1ST TIME DEGREE FRESH	0002	02=L140+L150					
170	003	TRANSFER FRESH IN-STATE	0001	01=L130*R003					
180	003	TRANSFER FRESHMAN OUT/STATE	0002	01=L130*R004					
190	001	TOTAL TRANSFER FRESHMAN	0002	03=L170+L180					
200	003	REPEATING FRESHMAN	0002	03=L130*R005					
210	001	TOTAL FRESHMAN	0002	03=L160+L190+L200					
220	001	SOPHMORE CLASS:	0015	02					
230	003	TRANSFER SOPHMORES	0001	01=L210*R006					
240	003	OTHER SOPHMORES	0002	01=L210*R007					
250	001	TOTAL SOPHMORES	0002	03=L230+L240					
260	001	TOTAL LOWER LEVEL	0002	01=L210+L250					
270	001	JUNIOR CLASS:	0013	P2					
280	003	TRANSFER JUNIORS	0001	01=L260*R008					
290	003	OTHER JUNIORS	0002	01=L260*R009					
300	001	TOTAL JUNIORS	0002	03=L280+L290					
310	001	SENIOR CLASS:	0013	02					
320	003	TRANSFER SENIORS	0001	01=L300*R010					
330	003	OTHER SENIORS	0002	01=L300*R011					
340	001	TOTAL SENIORS	0002	03=L320+L330					
350	001	TOTAL UPPER LEVEL	0002	03=L300+L340					
400	001	UNCLASSIFIED (NON-DEGREE):	0026	02					
410	001	1ST TIME UNCLASSIFIED	0001	01=0003					
420	003	OTHER 1ST TIME UNCLASSIFIED	0002	01=L410*R012					
430	001	TOTAL UNCLASSIFIED	0002	03=L410+L420					
440	001	SUB TOTAL - UNDERGRAD.	0002	01=L260+L350+L430					
500	001	GRADUATE:	0009	P2					
510	003	1ST YEAR GRADUATES	0001	01=L440*R013					
520	003	ADVANCE GRADUATES	0002	01=L440*R014					
530	001	TOTAL REGULAR GRADUATES	0002	03=L510+L520					
600	001	GRADUATES PRODUCED	0000	01					
610	001	BY NEW PROGRAMS:	0016	02					
650	003	1ST YEAR	0001	01=L530*R014					
660	003	ADVANCED	0002	01=L530*R015					
670	001	TOTAL NEW PROGRAM GRADUATES	0002	03=L650+L660					
700	001	COMBINED REGULAR AND NEW	0000	01					
710	001	PROGRAM PROJECTED GRADUATES:	0028	02					
720	001	1ST YEAR COMBINED	0001	01=L510+L650					
730	001	ADVANCED COMBINED	0002	01=L520+L660					
740	001	TOTAL COMBINED GRADUATES	0002	03=L720+L730					
800	001	TOTAL PROJECTED	0000	01					
810	001	UNIVERSITY ENROLLMENT	0003	01=L440+L740					
900	001	*** SUMMARY ***	0015	P2					
910	001	TOTAL FRESHMAN CLASS	0001	01=L210					
920	001	TOTAL SOPHMORE CLASS	0002	01=L250					
930	001	TOTAL LOWER LEVEL	0002	03=L260					
940	001	TOTAL JUNIOR CLASS	0001	01=L300					
950	001	TOTAL SENIOR CLASS	0002	01=L340					
960	001	TOTAL UPPER LEVEL	0002	03=L350					

APPENDIX B

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970 M01 TOTAL UNCLASSIFIED

0002 03=L430

975 M01 TOTAL UNDERGRADUATES

0002 03=L440

980 M01 TOTAL GRADUATES

0002 03=L740

990 M01 TOTAL UNIVERSITY

0003 05=L810

MODEL XX-06
ENROLLMENT PROJECTIONS

DATE 21-Feb-79

TIME 14:06 55.8

PAGE 1

	1977	1978	1979	1980	1981	1982	1983
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FRESHMAN CLASS:

PROJECTED 1ST TIME FRESHMAN	1418	1460	1493	1525	1548	1562	1571
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1ST TIME DEGREE FRESH IN-STATE	1273	1311	1341	1370	1390	1403	1411
1ST TIME DEG. FRESH OUT/STATE	238	246	251	257	260	263	264

TOTAL 1ST TIME DEGREE FRESH	1511	1557	1592	1627	1650	1666	1675
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TRANSFER FRESH IN-STATE	143	148	151	154	157	158	159
TRANSFER FRESHMAN OUT/STATE	37	39	39	40	41	41	42

TOTAL TRANSFER FRESHMAN	180	187	190	194	198	199	201
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REPEATING FRESHMAN	737	758	776	792	804	811	816
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TOTAL FRESHMAN	2428	2502	2558	2613	2652	2676	2692
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SOPHOMORE CLASS:

TRANSFER SOPHOMORES	436	449	459	469	476	480	483
OTHER SOPHOMORES	534	551	563	575	584	589	593

TOTAL SOPHOMORES	970	1000	1022	1044	1060	1069	1076
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TOTAL LOWER LEVEL	3398	3502	3580	3657	3712	3745	3768
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MODEL XX-36
ENROLLMENT PROJECTIONS

DATE 21-Feb-79

TIME 14:06 55.8

PAGE 2

	1977	1978	1979	1980	1981	1982	1983
JUNIOR CLASS:							
TRANSFER JUNIORS	504	519	531	542	551	555	559
OTHER JUNIORS	572	590	603	616	625	631	635
TOTAL JUNIORS	1076	1109	1134	1158	1176	1186	1194
SENIOR CLASS:							
TRANSFER SENIORS	109	112	115	117	119	120	121
OTHER SENIORS	28	29	30	31	31	31	31
TOTAL SENIORS	137	141	145	148	150	151	152
TOTAL UPPER LEVEL	1213	1250	1279	1306	1326	1337	1346
UNCLASSIFIED (NON-DEGREE):							
1ST TIME UNCLASSIFIED	718	768	783	796	805	811	812
OTHER 1ST TIME UNCLASSIFIED	373	399	407	413	418	421	422
TOTAL UNCLASSIFIED	1091	1167	1190	1209	1223	1232	1234
SUB TOTAL - UNDERGRAD.	5742	5919	6049	6172	6261	6314	6348

MODEL XX-06
ENROLLMENT PROJECTIONS

DATE 21-Feb-79

TIME 14:06 55.8

PAGE 3

1977 1978 1979 1980 1981 1982 1983

GRADUATE:

1ST YEAR GRADUATES	1024	1063	1087	1109	1125	1134	1140
ADVANCE GRADUATES	1256	1303	1332	1359	1379	1390	1398
TOTAL REGULAR GRADUATES	2280	2366	2419	2468	2504	2524	2538

GRADUATES PRODUCED
BY NEW PROGRAMS:

1ST YEAR	502	521	532	543	551	556	559
ADVANCED	231	240	245	250	254	256	257
TOTAL NEW PROGRAM GRADUATES	733	761	777	793	805	812	816

COMBINED REGULAR AND NEW
PROGRAM PROJECTED GRADUATES:

1ST YEAR COMBINED	1526	1584	1619	1652	1676	1690	1699
ADVANCED COMBINED	1487	1543	1577	1609	1633	1646	1655
TOTAL COMBINED GRADUATES	3013	3127	3196	3261	3309	3336	3354

TOTAL PROJECTED
UNIVERSITY ENROLLMENT

8715	9046	9245	9433	9570	9650	9702
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